What is Claimed Is:

1. A method of manufacturing granular magnetic recording media, comprising sequential steps of:

(a) providing a non-magnetic substrate including a surface;

(b) forming a layer stack on said surface of said substrate, said layer stack including an outermost granular magnetic recording layer with an exposed nano-scale rough and porous surface;

(c) treating said exposed nano-rough and porous surface of said granular magnetic recording layer to provide at least one of:

(i) a reduction of said nano-scale roughness and porosity;

(ii) increased compositional homogeneity;

(iii) increased microstructural homogeneity;

(iv) preferential removal of at least one element; and

(v) increased grain boundary coverage by a subsequently deposited protective overcoat layer; and

(d) forming a protective overcoat layer on the treated surface of said granular magnetic recording layer.

2. The method according to claim 1, wherein:

step (b) comprises forming a layer stack including an outermost granular perpendicular magnetic recording layer.

3. The method according to claim 1, wherein:

step (b) comprises forming a layer stack including an outermost granular longitudinal magnetic recording layer.

4. The method according to claim 1, wherein:

step (c) comprises etching said surface of said granular magnetic recording layer.

5. The method according to claim 4, wherein:

step (c) comprises sputter etching said surface.

6. The method according to claim 5, wherein:

step (c) comprises sputter etching said surface with ions of an inert gas.

7. The method according to claim 6, wherein:

step (c) comprises sputter etching said surface with Ar ions.

8. The method according to claim 1, wherein:

step (d) comprises forming a carbon (C)-containing protective overcoat layer.

9. The method according to claim 8, wherein:

step (d) comprises forming a diamond-like carbon (DLC) protective overcoat layer.

10. The method according to claim 9, wherein:

step (d) comprises forming said DLC protective overcoat layer by ion beam deposition (IBD).

11. The method according to claim 1, wherein:

step (a) comprises providing a non-magnetic substrate comprised of a non-magnetic material selected from the group consisting of: Al, NiP-plated Al, Al-Mg alloys, other Al-based alloys, other non-magnetic metals, other non-magnetic alloys, glass, ceramics, polymers, glass-ceramics, and composites and/or laminates of the aforementioned materials.

12. The method according to claim 1, wherein:

step (b) comprises forming a layer stack including a granular Co-based alloy magnetic recording layer comprised of a CoPtX alloy, where X = at least one element or material selected from the group consisting of: Cr, Ta, B, Mo, V, Nb, W, Zr, Re, Ru, Cu, Ag, Hf, Ir, Y, O, Si, Ti, N, P, Ni, SiO_2, SiO, Si_3N_4, Al_2O_3, AlN, TiO, TiO_2, TiO_x, TiN, TiC, Ta_2O_5, NiO, and CoO, and wherein Co-containing magnetic grains are segregated by grain boundaries comprising at least one of oxides, nitrides, and carbides.

13. The method according to claim 1, further comprising a step of:

(e) forming a lubricant topcoat layer on said protective overcoat layer.

14. The method according to claim 13, wherein:

step (e) comprises forming a layer of a perfluoropolyether material.

15. A granular magnetic recording medium, comprising:

(a) a non-magnetic substrate having a surface;

(b) a layer stack on said substrate surface, said layer stack including a granular magnetic recording layer having a surface distal said substrate surface treated to provide at least one of:

(i) a reduction of nano-scale roughness and porosity;

(ii) increased compositional homogeneity;

(iii) increased microstructural homogeneity;

(iv) preferential removal of at least one element; and

(v) increased grain boundary coverage by a subsequently deposited protective overcoat layer; and

(c) a protective overcoat layer on the treated surface of said granular magnetic recording layer.

16. The medium as in claim 15, wherein:

said granular magnetic recording layer is a longitudinal magnetic recording layer.

17. The medium as in claim 15, wherein:

said granular magnetic recording layer is a perpendicular magnetic recording layer.

18. The medium as in claim 15, wherein:

said distal surface of said magnetic recording layer is sputter etched with ions of an inert gas.

19. The medium as in claim 15, wherein:

said non-magnetic substrate comprises a non-magnetic material selected from the group consisting of: Al, NiP-plated Al, Al-Mg alloys, other Al-based alloys, other non-magnetic metals, other non-magnetic alloys, glass, ceramics, polymers, glass-ceramics, and composites and/or laminates of the aforementioned materials.

20. The medium as in claim 1, wherein:

said granular Co-based alloy magnetic recording layer comprises a CoPtX alloy, where X = at least one element or material selected from the group consisting of: Cr, Ta, B, Mo, V, Nb, W, Zr, Re, Ru, Cu, Ag, Hf, Ir, Y, O, Si, Ti, N, P, Ni, SiO_2, SiO, Si_3N_4, Al_2O_3, AlN, TiO, TiO_2, TiO_x, TiN, TiC, Ta_2O_5, NiO, and CoO, and wherein Co-containing magnetic grains are segregated by grain boundaries comprising at least one of oxides, nitrides, and carbides.

21. The medium as in claim 15, wherein:

said protective overcoat layer comprises a carbon (C)-containing material.

22. The medium as in claim 21, wherein:

said protective overcoat layer comprises a diamond-like carbon (DLC) material.

23. The medium as in claim 22, wherein:

said protective overcoat layer comprises an ion beam deposited (IBD) DLC material.

24. The medium as in claim 15, further comprising:

(d) a lubricant topcoat layer on said protective overcoat layer.

25. The medium as in claim 24, wherein:

said lubricant topcoat layer comprises a perfluoropolyether material.